

4.2 Using production, trade, and sales data in tobacco control

Introduction

Article 20 of the Framework Convention on Tobacco Control (FCTC) calls for parties to:

- “(a) establish progressively a national system for the epidemiological surveillance of tobacco consumption and related social, economic and health indicators;
- (b) cooperate with competent international and regional inter-governmental organizations and other bodies, including governmental and nongovernmental agencies, in regional and global tobacco surveillance and exchange of information on the indicators specified in paragraph 3(a) of this Article” (WHO, 2003).

One can envisage that as the FCTC is progressively implemented in a substantial number of countries, a comprehensive and sustainable surveillance system will emerge. Such a system would allow advocates and researchers a one stop source of information where comparable key tobacco control statistics, such as mortality attributable to tobacco use, prevalence of tobacco use, and consumption of and trade in manufactured tobacco products are accessible. Unfortu-

nately, such a system is not yet available. Tobacco control researchers and advocates must find important data, such as cross-country estimates of production, trade, and tobacco consumption from a variety of sources.

The objectives of this section are 3-fold: to discuss the potential usefulness of production and trade data in tobacco control, with particular attention to the advantages and disadvantages of using these data to measure tobacco consumption; to examine the use of export and import statistics for measuring the illegal cigarette trade; and to review the availability and quality of existing data.

Trade and production data in tobacco control

Data on trade and production of manufactured tobacco products can be obtained from national statistical agencies and international databases with relative ease and provide valuable information to tobacco control advocates. First, production data can provide a good indicator of the importance of the national tobacco industry at both the national and international levels and, in the absence of trade, production data can provide an accurate measure of the national tobacco market. Secondly, data on

the import and export of manufactured tobacco products can provide valuable information on important, key players in the national tobacco control debate. For example, a close examination of trade patterns in tobacco products can reveal the precise origin of cigarette imports; similarly, it can identify key export markets. Such information can be invaluable in identifying important players in the national tobacco control arena. Finally, production figures can be combined with import and export figures, to provide a measure of national consumption of manufactured tobacco products that may be useful in attempting to quantify the magnitude of the smuggling market. Sales data, based on tax records, can also be used as an estimate of the consumption of various tobacco products.

Using aggregate data to measure cigarette consumption: advantages and disadvantages

Estimates of consumption and prevalence of use of tobacco products can originate from various types of data. They can be based on (self-reported) tobacco use prevalence surveys, which provide information on the proportion of tobacco users in a given population.

Prevalence data combined with tobacco use intensity data (e.g. number of cigarette smoked per day) can also yield total consumption estimates. Consumption can also be derived from aggregate production and trade statistics. Production plus imports minus exports will yield “apparent” consumption estimates. For example:

- cigarette consumption = cigarette production + cigarette imports – cigarette exports
- per capita cigarette consumption = cigarette consumption / (pop. 15+)

National cigarette sales data, based on sales or tax records, can also be an estimator of consumption (Guindon & Boisclair, 2003).

Prevalence surveys can provide important insights into patterns of and changes in consumption according to sex, age, income, and education (Warner, 1977). They also allow distinguishing between a change in the number of smokers and changes in consumption per smoker. On the other hand, consumption data (the number of cigarettes consumed) based on surveys can suffer from significant underreporting (Warner, 1978; Jackson & Beaglehole, 1985; Hatzianreou *et al.*, 1989; Foss *et al.*, 1998). Surveys generally provide valid estimates of prevalence (Velicer *et al.*, 1992; Patrick *et al.*, 1994; Caraballo *et al.*, 2001; Caraballo *et al.*, 2004), suggesting that the number of

cigarettes smoked each day is underreported. In addition, many population-based surveys do not interview people in the military, prison, and psychiatric institutions and thus will not assess use in populations with fairly substantial smoking prevalence. Another potential limitation is the infrequent availability of trend data. Finally, the subjective nature of surveys and differences in survey methodology (questions, definitions, languages, etc.) also make comparison of estimates across countries difficult.

Aggregate production and trade statistics are objective data that eliminate the underreporting problem inherent in data based on subjective survey responses (Warner, 1977). These data are also readily available across time and countries. This feature, as well as the availability of centralized data sources using common methodologies, allows for good comparability. However, most of these large-scale tobacco statistics are only available for manufactured cigarettes. Data from the Global Youth Tobacco Survey (GYTS) indicate that more than 10% of students used tobacco products other than cigarettes, with the rate being highest in the southeast Asia region and the eastern Mediterranean region (Warren *et al.*, 2006). Specific examples include: India where tobacco consumption is dominated by use of non-cigarette tobacco (bidis, leaf tobacco etc.), resulting in cigarette consumption representing only 15% of total

tobacco consumption (Rijo, 2005); and Thailand where high levels of use of hand-rolled tobacco have been reported (Sarntisart, 2003)

The major problem with aggregate data is perhaps that, unlike prevalence survey-based data, they cannot be used for analyzing changes in sex, age, income, and education distribution, and they do not permit a distinction between a change in the number of smokers and changes in consumption per smoker (Warner, 1977). Other important problems include illicit trade in cigarettes and illegal manufacturing and counterfeit trade, resulting in export and import data not being registered in official figures, which may lead to under or overestimating consumption of tobacco products (WHO, 1998a). The problem of stockpiling may also emerge, as not all cigarettes will be consumed in the year they are produced or imported. If this stockpiling is significant it may bias consumption estimates. However, it is doubtful that stockpiling will affect trends since it is not likely to vary from year-to-year, although tobacco companies have been known to time cigarette stockpiling against health measures so that they appear less effective (WHO, 1998a). Transient populations will affect aggregate trade and production statistics to a varying degree. Finally, the question of measurement units can yield diverging trends and biased point estimates. More specifically:

- “Apparent” consumption will underestimate true consumption in countries where tobacco products are illegally imported and consumed, while it will overestimate true consumption where tobacco products are illegally exported to another country.
- Trade and production data can be reported in weight or in physical units. In countries where cigarette weights have not remained constant over time, cigarette consumption expressed in units and in weight can show diverging trends. For example, Australian cigarettes became progressively lighter in the late 1980s. When expressed in grams per capita, cigarette consumption in Australia fell by 4.9% between 1986 and 1990, while it increased by 5% when expressed in units (Chapman, 1992).
- Trade and production statistics for an individual country can also be reported in different units. For example, manufactured cigarette imports and exports are often reported in metric tons, while production is expressed in units. When this is the case, it is usually assumed in the calculations that one cigarette weighs one gram. But this assumption may not hold and thus bias consumption estimates. The direction of the bias will depend on two factors: the true “conversion factor,” and the respective size of imports and exports. For example, in a country where production statistics are expressed in

units, trade statistics in metric tons, and one gram of cigarette equals one cigarette, true consumption will be over-estimated if the country is a net importer of cigarettes, and underestimated if the country is a net exporter.

- “Apparent” consumption will overestimate true consumption in countries with large transient populations (for example tourists or military), and small indigenous populations, such as Malta and the Maldives.

In addition to the measurement issues described above, production and trade figures reported by national statistical agencies may not accurately reflect true figures. There may be a time lag of three to six months between recording export and import statistics. It may also be the case that import statistics are recorded more rapidly and accurately because of more prevalent import duties (as compared to export duties). Finally, there may be reporting errors at the national level, and between the national statistical agencies, international agencies, and organisations that report cross-country statistics.

Production data can be used at the global level as a proxy for world consumption. It will be a poor proxy for consumption in most countries, but as world exports must equal world imports, aggregating cigarette production for all countries would do away with the problems associated with smuggling and attenuate the problems associated with measurement units. Unfortunately, because of unequal data availa-

bility through time, adding all production data points in a particular year can lead to under-estimation.

Sales data based on tax records are also aggregate data, and similarly present the same general advantages and disadvantages as those described above for production and trade statistics. It should be noted, however, that sales data are not as readily available across countries and are not available in centralised databases. On the other hand, they do not suffer from the limitations associated with measuring and reporting units or stockpiling. They also present the advantage (unlike estimates obtained from trade and production statistics) of yielding consumption estimates that exclude duty-free sales, most of which are to non-residents and are not consumed in the country. Finally, sales data may be segmented by tobacco products (e.g. cigarettes, cigars, etc.), brands and brand variant (e.g. length-type, and descriptor-type, such as “light” or “mild”), and thus yield information on market shares by individual brands, brand family, and brand variant.

Population adjustments:

Total cigarette consumption can be useful to gauge the size of a tobacco market, but it does not allow for comparison across time and across countries. To achieve the latter, total cigarette consumption or sales can be weighted by population in order to provide an indicator of individual

consumption, usually by dividing total cigarette consumption by the population aged 15 years and above. The age group 0-14 is normally omitted because of its limited contribution to tobacco use (Chapman, 1992). However, differences between countries in demographic distribution and tobacco use prevalence in the 10-20 age group can be important and diminish comparability.

The use of export and import statistics for measuring the illegal cigarette trade

The gap between global exports and global imports is often used to make estimates of the overall size of cigarette smuggling. World cigarette production is known fairly accurately, and, since there are not large numbers of cigarettes in storage because they do not keep for long, world production is very close to world consumption. Global imports should thus be close to exports, after allowing for legitimate trade usually excluded from national statistics. (These are principally imports for duty-free sales to travellers, diplomatic staff, and military establishments.)

Imports, however, have long been lower than exports to an extent that cannot be explained by legitimate duty-free sales. Even the lag time of three to six months between recording export and import statistics, cannot explain the differences between them which have been high for years. Worldwide, United States Department of

Agriculture (USDA) data showed that recorded cigarette exports exceeded recorded imports by more than 300 billion each year in the period 1995-2000. The only plausible explanation for these missing cigarettes is smuggling (Joossens & Raw, 1995; Joossens & Raw, 1998).

Some cautious interpretation of these results is advisable (Merriman *et al.*, 2000). Many factors may explain a discrepancy between recorded exports and imports. An analysis of data from the United Nations Commodity Trade Statistics Database (UN Comtrade) shows large discrepancies between total reported imports and exports of many goods. However, researchers admit that cigarettes are different from other commodities, as cigarette exports consistently greatly exceed imports. It is concluded that the most reasonable explanation for the observed data is that a large and growing fraction of international trade is smuggled (Merriman *et al.*, 2000).

USDA statistics for the period 2001-2004 showed that the gap between recorded cigarette imports and exports had been reduced to around 150 billion cigarettes annually. There may be different explanations for these reductions. USDA data are not always reliable at the national or worldwide level. In 2002, the USDA magazine *Tobacco: World Markets and Trade* published data which showed that the gap between exports and imports was 276 billion cigarettes in 2001. Two years later, the same magazine

released figures which showed that the gap had been reduced to 126 billion cigarettes in 2001. Caution with the analysis of USDA data is necessary.

Another explanation might be that the reduction of smuggling occurred as some major international tobacco companies have reviewed their export practices due to lawsuits. The reduction of the gap may finally be explained through the increase of illegal manufacturing and counterfeit cigarette trade, which is a growing concern in many countries. The illegal nature of their production means that they are not registered in the official export and import data.

Finally, the analysis of export and import practices can also be used to study the smuggling problem at the national level. For instance, exports from the British tobacco companies to Andorra increased from 13 million cigarettes in 1993 to 1,520 million in 1997. Taking into account that almost none of these cigarettes were legally re-exported, that Andorra only has a population of 63000, and that smokers in Andorra on the whole do not smoke British brands, it was clear that these increased exports were intended for the smuggling market (Joossens & Raw, 2002). Induced by high taxes in the early 1990s, cigarette smuggling increased substantially in Canada. Virtually all smuggled cigarettes had been previously exported from Canada. As Canada did not, and still does not, export a large amount of cigarettes, exports proved to be

an accurate indicator for smuggling (Galbraith & Kaiserman, 1997). Similarly, a significant and unlikely decrease in “apparent” cigarette consumption per capita was observed in Brazil, while “apparent” consumption was rising rapidly in Paraguay in the late 1980s and early 1990s, driven by a 16-fold increase in exports to Paraguay (Shafey *et al.*, 2002).

The aforementioned examples indicate the usefulness of examining production, trade, and consumption data to gain insights into the smuggling market. That said, other methods exist and have been used to estimate the size of national smuggling market. Tobacco consumption estimated from production and trade or sales data can be compared to estimates of consumption based on prevalence surveys while taking into account under-reporting. The United Kingdom has used this method extensively to estimate the size of the smuggling market (for more details, see HM Customs & Excise, 2001). In Thailand, individuals who reported using tobacco products during face-to-face interviews, were asked to present their tobacco package to the interviewer. An examination of the health warnings (i.e. absence of warnings or a warning in a language other than Thai) can reveal if the tobacco products are likely to have been legally purchased (Sarntisart, 2003).

Availability and quality of existing data

This section describes various cross-country sources of production and trade statistics that provide information on manufactured tobacco products, and discusses their strengths and weaknesses.

United Nations Commodity Trade Statistics Database (UN Comtrade):

The United Nations Commodity Trade Statistics Database (UN Comtrade) contains detailed import and export statistics, including manufactured cigarettes and cigars, cheroots, and cigarillos reported by statistical authorities of close to 200 countries or areas (<http://unstats.un.org/unsd/comtrade/>). It contains annual trade (import and export) data from 1962 to the present. UN Comtrade is considered the most comprehensive trade database available and is continuously updated. Unlike other existing data sources where only total amounts are obtainable, UN Comtrade makes available the complete trade matrix. Whenever trade data are received from the national authorities, they are standardised by the United Nations Statistics Division and then added to UN Comtrade. Despite its comprehensiveness and its online availability, UN Comtrade is rarely used by tobacco control researchers and advocates.

United Nations Statistical Division (UNSD) Industrial Commodity Production Statistics Dataset:

The current version of the UNSD Industrial Commodity Production Statistics Dataset contains the entire database of industrial commodity statistics, including manufactured cigarettes and cigars, cheroots, and cigarillos covering the period 1950-2003 (1970-2003 for manufactured cigarettes). Data for the time period 1994-2003 are available in print in the *2003 Industrial Commodity Statistics Yearbook* (United Nations Statistical Division, 2003). The data contained in this database has primarily been collected from questionnaires sent yearly to national statistical authorities. However, data have also been collected from other governmental agencies, specialised agencies, intergovernmental bodies, private institutes, and associations. The UNSD Industrial Commodity Production Statistics Dataset can be considered the most reliable and comprehensive production dataset available (http://unstats.un.org/unsd/industry/ics_intro.asp).

Food and Agriculture Organization of the United Nations' (FAO) FAOSTAT:

The Food and Agriculture Organization of the United Nations' FAOSTAT provides access to over 3 million time-series and cross-sectional data relating to

food and agriculture from over 100 countries and areas (<http://faostat.fao.org/>).

The FAOSTAT TradeSTAT module contains detailed agricultural trade data, including import and export statistics for manufactured cigarettes and cigars, cheroots, and cigarillos (i.e. as a grouping). Data are obtained from national statistical and agricultural agencies and are standardised, processed, and validated by the FAO Statistics Division, whereby the national commodity classification (usually the Harmonized System) is converted to the FAO commodity classification. TradeSTAT has just recently begun providing detailed trade matrices.

United States Department of Agriculture (USDA), Foreign Agricultural Service (FAS):

- *Tobacco: World Markets and Trade* (http://www.fas.usda.gov/tobacco_arc.asp)
- *Attaché Reports* (<http://www.fas.usda.gov/scriptsw/AttacheRep/default.asp>)

The USDA's FAS World Market and Trade reports provide the latest data on a number of agricultural commodities, outlining the current supply, demand, and trade estimates both for the USA and for many major countries. FAS international offices provide information on production, consumption, and trade of many commodities, including manufactured cigarettes. It should be noted that

the data contained in these commodity and country reports are not official USDA data, but represent estimates made by FAS Attachés. The publication *Tobacco: World Markets and Trade* was discontinued in September 2005, while tobacco attaché reports were discontinued in January 2006.

Data from the USDA are arguably the most widely used and cited cross-national consumption and trade statistics in tobacco control research and advocacy. The WHO Global Status Report (WHO, 1997) relies almost exclusively on data from the USDA. The much cited analysis of the impact of USA trade policy on cigarette use in Asia, utilised cigarette consumption estimates that were derived from USDA data (Chaloupka & Laixuthai, 1996). Other more recent research examples include Gilmore & McKee (2004) and Gilmore & McKee (2005).

Market research reports:

There is a plethora of reports published by market research firms on the manufactured tobacco sector. Most provide country snapshots using various market size indicators including apparent consumption, which, as mentioned earlier, is constructed from trade and production figures. These reports often present market share data by brands, brand families, and companies. Many reports offer little original information (e.g. some rely almost entirely on USDA published data).

The World Cigarette Reports, published by ERC Statistics International PLC, a London-based market research organisation, provides some original statistical information, including up-to-date production and trade figures for a number of countries covered (ERC Statistics International PLC, World Cigarette Markets; <http://www.erc-world.com>).

United Nations Population Division (UNOP) – World population prospects:

This dataset provides the official United Nations population estimates and projections prepared by the Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat (<http://www.un.org/esa/population/publications/WPP2004/wpp2004.htm>). Detailed population estimates stratified by sex and age for close to 200 countries and areas are available.

In addition to the data sources discussed above, there exists a number of initiatives that report cross-country data for smaller groupings of countries often on a regional basis. Examples include the Organization for Economic Cooperation and Development (OECD) Health Data which reports tobacco consumption estimates for OECD member states. The latest version of the OECD database was released in June 2006, and contains a number of comparable statistics on health and health systems across OECD countries. The database contains more than

1200 series covering a wide range of health topics (i.e. health status, health care resources, health care utilisation, expenditure on health, health care financing, social protection, pharmaceutical market, and non-medical determinants of health). OECD Health Data is developed jointly by the OECD Secretariat and the Institut de Recherche et d'Étude en Économie de la Santé (IRDES), a French research institute specialising in health economics and health statistics. The data are compiled from national statistical agencies and other relevant national organisations (http://www.oecd.org/document/30/0,2340,en_2825_495642_12968734_1_1_1_1,00.html).

A second cross-country data source is the Interstate Statistical Committee of the Commonwealth of Independent States (CIS), Official Statistics of the Countries of the CIS (the CIS is comprised of Azerbaijan, Armenia, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Russia, Tajikistan, Turkmenistan, Uzbekistan, and Ukraine). The CIS database (<http://www.cisstat.com/eng/cd-offst.htm>) is updated annually and contains annual data on more than 3500 socioeconomic indicators from 1980 for all CIS countries. Another data source is the Asian Development Bank

(ADB) Key Indicators (http://www.adb.org/Documents/Books/Key_Indicators/2006/default.asp), which reports up-to-date manufactured cigarette statistics for a number of countries. Most data, but not all, contained in the OECD, CIS, and ADB databases are also available in the UN databases discussed earlier. However, these databases offer a relatively easy opportunity to compare estimates of consumption and production from multiple sources.

Discussion

It is important to point out that a large amount of the data published and available from the data sources described above can differ substantially. In particular, the trade data reported by the USDA, UN Comtrade, and the FAO differ widely at times. This makes it important to use the best available data by first comparing data from multiple sources.

It is generally the opinion that data from UN Comtrade (export and import) and UNSD (production) are the most reliable and comprehensive available. FAO's TradeSTAT is a good source of data that can be used alongside UN Comtrade. Of particular concern are the country data published by the USDA. They are often significantly at odds from

those published by other organisations, such as the United Nations Statistical Division and the FAO, or by national statistical agencies. For a great number of low- and middle-income countries (e.g. Albania, Algeria, Bangladesh, Bolivia, Ecuador, Jordan, Lebanon, and Viet Nam), USDA cigarette production and trade data appear at best to be an extrapolation based on a "guesstimate." As discussed earlier, an examination of what is often referred to as the size of the smuggling market (the difference between total exports and total imports) yields a very different picture if looking at data from the USDA or FAO (UN Comtrade does not publish global figures of manufactured cigarettes import and export) (Guindon & Boisclair, 2003). For these reasons, it is strongly suggested to use published USDA data for low- and middle-income countries with great caution.

Researchers and advocates interested in production, trade, and consumption estimates from a single country are advised to always look first at potential local and national primary sources of information, such as government statistics agencies and ministries of trade and industry.